

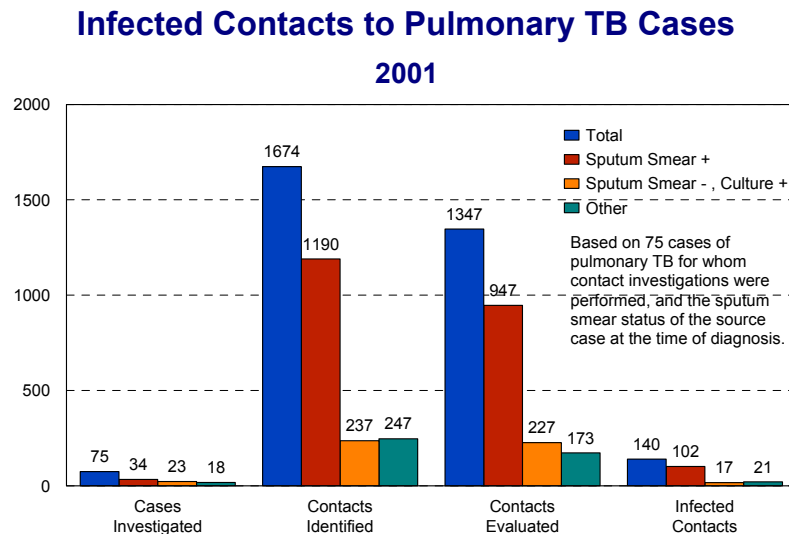
Infectiousness of Tuberculosis

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Tuberculosis (TB) is a communicable disease caused by the bacterium *Mycobacterium tuberculosis*, also known historically as the tubercle bacillus. *M. tuberculosis* is one of five species which constitute the *M. tuberculosis*, or MTB complex. The others are *M. bovis*, *M. africanum*, *M. canettii*, and *M. microti*. Infection is transmitted when tubercle bacilli are expelled into the air when someone with TB disease in the lung or elsewhere in the airway coughs, sneezes, or performs some other forceful expiratory action. The bacilli are attached to droplet nuclei, which are the dried residue of the expired respiratory secretions. Particles 1-5 microns in diameter can remain airborne for several hours. The larger particles fall to the surface. Transmission may occur if another person inhales these droplet nuclei.

Unlike other airborne diseases that are highly infectious, such as measles, TB is relatively difficult to transmit and generally requires close, prolonged contact over long periods of time. With extremely rare exceptions, only persons with active disease in the lung or larynx can transmit the disease to others. Transmission involving contact with extrapulmonary TB has been limited to such instances as penetrating injuries among laboratory and autopsy personnel, and inhalation of aerosols created by surgical wound irrigation devices. Figure 1 shows the breakdown of Indiana TB cases by site of disease in 2001.

Figure 1.

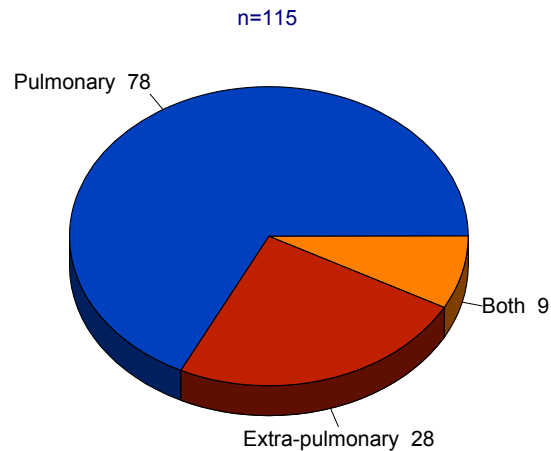


Source: Indiana State Department of Health TB Control Program

Not all patients with pulmonary disease are infectious at the time of diagnosis, and relatively few contacts actually become infected (figure 2), although the number of infected contacts per case is highly variable.

Figure 2.

TB Cases by Site of Disease, 2001



Source: Indiana State Department of Health TB Control Program

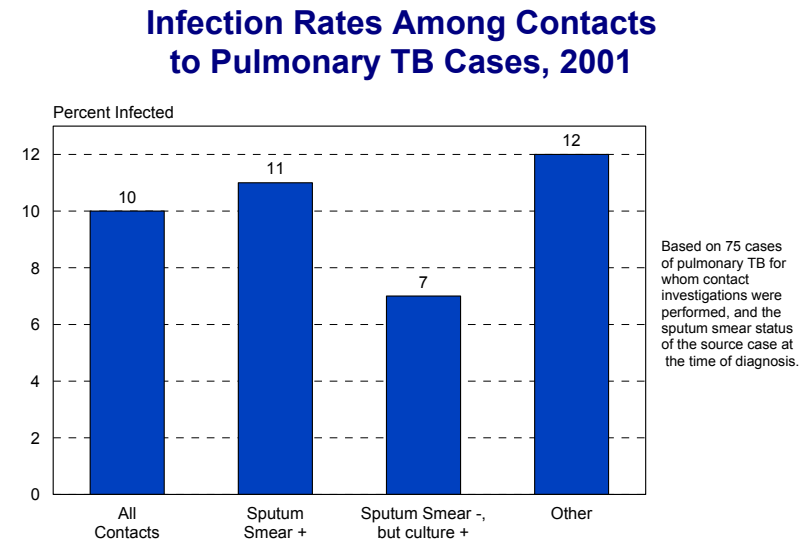
Like other communicable diseases, the probability of TB transmission depends on several factors:

- 1) the infectiousness of the person with TB. It has long been known that the untreated patient with acid-fast bacilli (AFB) in the sputum and extensive cavitory disease is most likely to transmit TB to others. The frequency of coughing also plays an important role. The absence of AFB in the sputum decreases, but does not eliminate, the level of infectiousness.
- 2) the environment in which the exposure occurred. TB transmission favors enclosed, poorly ventilated spaces. This is why TB is transmitted mostly in household and many types of social settings, such as bars, pool halls, and abandoned houses frequented by the homeless.
- 3) the frequency and duration of the exposure. It has been estimated that, on average, it takes the equivalent of 8 hours of exposure per day for a person to have a 50 percent chance of becoming infected. This is in sharp contrast to a child with measles or chickenpox infecting the majority of non-immune close contacts after only a few hours of exposure. Instances where persons are infected with TB after brief, less-than-close contact are uncommon, but do occur.

It has been estimated that infectious TB patients infect an average of 10 contacts prior to the initiation of chemotherapy. Infection rates can be difficult to quantify on a national level. Infection rates for contacts of pulmonary TB cases in Indiana during 2001 are shown in figure 3. This is the most recent year with complete contact investigation data. The rates are broken down according to the sputum AFB smear and culture status of the source case: sputum smear positive, regardless of culture results, sputum smear negative but culture positive, and "other." The "other" category includes contacts to source cases for whom sputum was not collected, or who had positive cultures only from respiratory specimens other than sputum. Many patients in the last category were found to be sputum smear positive after their initial

medical evaluation, and would have certainly been sputum smear positive at the time of diagnosis had pre-treatment sputum specimens been collected.

Figure 3.



Source: Indiana State Department of Health TB Control Program

The most effective control measures for TB transmission are to isolate the TB patient, immediately begin effective anti-TB chemotherapy, and instruct the patient to cover his or her mouth and nose when coughing or sneezing. Infectiousness usually declines rapidly once treatment is started, as long as the patient adheres to the treatment regimen. However, persons with multi-drug resistant TB are often infectious for longer periods, and thereby have the potential to transmit TB more people.

There is no “specific time frame” for how long TB patients need to be on medication before they are no longer infectious. Although the traditional time of two weeks of therapy has been considered adequate to render a patient sufficiently non-infectious in the past, the evidence is, at best, circumstantial. For patients whose pre-treatment sputum is negative for AFB, two weeks of treatment is probably sufficient. That is probably not always the case for patients whose sputum is smear-positive. The truth is that no one knows precisely when patients are no longer infectious. The current guidelines established by the American Thoracic Society and adopted by the Indiana State Department of Health state that patients are considered to be no longer infectious when all of the following criteria are met:

- They are on an adequate treatment regimen
- They have had a significant clinical response to therapy, particularly resolution of coughing, and
- They have had 3 consecutive negative sputum smear results from specimens collected 8-24 hours apart

When the word “tuberculosis” is mentioned, people immediately think of active TB disease and the images of very ill people with a chronic, persistent cough who spread this terrible disease to others. Awareness was heightened as a result of well-documented outbreaks in the 1980s and early 1990s. People asking, “Am I going to catch TB?”, were given a complicated and incomplete answer because

most of the understanding about the infectiousness of TB is the result of observations of natural occurrences and accidents rather than intentional scientific study. The use of other molecular laboratory techniques will hopefully give a better understanding of the principles of TB transmission.

References:

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